Trap Assisted Auger Recombination

This model adds in a dependence of recombination lifetime on carrier density, and will only be significant at fairly high carrier densities [79].

The carrier lifetimes are reduced according to the following formula

$$\tau_n = \frac{\tau_n}{(1 + \mathrm{TAA.CN}(n+p)\tau_n)} \qquad 3\text{-}323$$

$$\tau_p = \frac{\tau_p}{(1 + \mathrm{TAA.CP}(n+p)\tau_p)} \qquad 3\text{-}324$$

where n is the electron density and p the hole density. To enable the model, specify `TRAP.AUGER` on the `MODELS` statement. It will then apply to the SRH model if enabled or to the CDL model if enabled.

You can set the parameters on the `MATERIAL` statement with the defaults as shown in Table 3-71.

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Table 3-71 Parameters for Trap assisted Auger model

Statement	Parameter	Units	Default
MATERIAL	TAA.CN	cm^3/s	1.0×10^{-12}
MATERIAL	TAA.CP	cm^3/s	1.0×10^{-12}

Trap-Assisted Tunneling

In a strong electric field, electrons can tunnel through the bandgap via trap states. This trap-assisted tunneling mechanism is enabled by specifying `TRAP.TUNNEL` on the `MODELS` statement and is accounted for by modifying the Schockley-Read-Hall recombination model.

$$R_{SRH} = \frac{pn - n_{ie}^2}{\frac{\mathrm{TAUP0}}{1+\Gamma_p^{DIRAC}}\left[n + n_{ie}exp\left(\frac{\mathrm{ETRAP}}{kT_L}\right)\right] + \frac{\mathrm{TAUN0}}{1+\Gamma_n^{DIRAC}}\left[p + n_{ie}exp\left(\frac{-\mathrm{ETRAP}}{kT_L}\right)\right]} \qquad 3\text{-}325$$

Here, Γ_n^{DIRAC} is the electron field-effect enhancement term for Dirac wells, and Γ_p^{DIRAC} is the hole field-effect enhancement term for Dirac wells. Γ_n^{DIRAC} and Γ_p^{DIRAC} are defined in Equations 3-82 and 3-83.